Research Article

Maternal Mortality and Contributing Risk Factors

Kematian Maternal dan Faktor-Faktor Risiko yang Mempengaruhinya

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Abstract

Objectives: Maternal mortality is one indicator to assess a nation's health care quality. This research was conducted to determine the determinant risk factors for maternal mortality.

Methods: A retrospective case control study at Dr. Mohammad Hoesin General Hospital for 5 years, with 200 samples consists of 50 cases of maternal mortality and 150 physiological labor cases as control group.

Results: For 5 years, there was 109 cases of maternal mortaliy. Of the 50 samples of maternal mortality cases, the most common cause were preeclampsia/eclampsia (50%), followed by hemorrhage (28%). The risk factors were categorized as distant, intermediate, and outcome factors, as stated by McCarthy et al. On bivariate analysis, we found the significance on maternal education and husband's occupation (distant factors), residence, referral status, numbers of ANC visits, first attendant, labor facility and history of prior medical history (intermediate factors), and also modes of delivery and complications (outcome factors). On the multivariate analysis to determine the most contributing risks factors for maternal mortality, it was found that maternal education and residence were the most influencing factors for maternal mortality (OR 5.74 and 4.65 respectively; p=0.001).

Conclusions: The most contributing risks factors for maternal mortality were maternal education and residence.

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Keywords: case control study, maternal mortality, risk factors.

Abstrak

***Tujuan**: Kematian maternal merupakan salah satu indikator untuk menilai kualitas pelayanan kesehatan di suatu negara. Karena itu, penting untuk memahami faktor-faktor yang mempengaruhi kematian maternal. Penelitian ini bertujuan untuk mengetahui faktor-faktor risiko yang mempengaruhi kematian maternal.*

***Metode**: Penelitian retrospektif selama 5 tahun (2005-2009) dengan desain studi kasus kontrol di RS Dr. Mohammad Hoesin Palembang, dengan sampel 200 orang, yang terdiri atas 50 kasus kematian maternal dan kontrol 150 kasus persalinan fisiologis.*

***Hasil**: Selama 5 tahun terdapat 109 kasus kematian maternal. Dari 50 sampel kasus kematian maternal, penyebab kematian tertinggi adalah preeklampsia/eklampsia (50%) diikuti dengan perdarahan (28%). Faktor risiko terbagi atas faktor jauh, faktor antara dan faktor hasil, berdasarkan skema yang dikemukakan McCarthy dan Maine. Dilakukan analisis bivariat pada semua faktor, didapatkan hasil yang bermakna pada pendidikan ibu dan pekerjaan suami (faktor jauh), tempat tinggal, status rujukan, jumlah kunjungan ANC, penolong pertama, tempat bersalin dan riwayat penyakit ibu (faktor antara), serta jenis persalinan dan komplikasi (faktor hasil). Kemudian dilakukan analisis multivariat untuk mencari faktor yang paling mempengaruhi kematian maternal, didapatkan bahwa pendidikan dan tempat tinggal merupakan faktor yang mempe-ngaruhi terjadinya kematian maternal (OR masing-masing 5,74 dan 4,65 dengan p=0,001).*

***Kesimpulan**: Faktor risiko yang paling berperan terhadap terjadinya kematian maternal adalah faktor pendidikan ibu dan faktor tempat tinggal.*

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***Kata Kunci**: faktor risiko, kematian maternal, studi kasus-kontrol.*

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INTRODUCTION

Morbidity and mortality in pregnant and birthing women is a major problem in developing countries. Maternal mortality is one indicator to assess the quality of health care in a country. WHO defines maternal mortality as the mortality of women during pregnancy or within 42 days after the end of pregnancy, regardless of gestational age and location, by any cause related to or aggravated by pregnancy or its handling but not by accident or incidental (coincidence).[1]

Maternal mortality rate in Indonesia is not yet known with certainty, because the system for recording and reporting on a national scale has not been running, as well as the referral system. Up until now, MMR could not decrease as expected. Demographic and Health Survey data of 2007 states that MMR in Indonesia is still 228 per 100,000 live births.[2] CBS projected that the MMR will only reach 163 maternal mortality per 100,000 live births in 2015, while the MDG target by 2015 is 102.[3]

It is important to understand the factors that affect maternal mortality. According to McCarthy et al, a series of factors that affects maternal mortality can be described in a simple framework. This framework consists of three stages of the factors: distant factors, intermediate factors, and near factors (outcome).[4] Most of maternal mortality could be prevented, but only little attention given to record the number of women who experienced a fatal complication. Information about the cause of mortality, distribution and its determinant factors are essential in the management of public health. These information are needed to determine the priority health care programs, plan the actions/interventions, and monitor the program's effectiveness. For that, it required the collection of data and research on maternal mortality and the influencing factors in Dr. Mohammad Hoesin General Hospital Palembang for five years (2005-2009).

METHODS

This study is an observational case control study, conducted in the Dr. Mohammad Hoesin General Hospital Palembang from January 1, 2010 through December 31, 2011. Secondary data was collected from medical records, mortality records and reports of maternal mortality in patients hospitalized in the Obstetrics and Gynecology department of Dr. Mohammad Hoesin General Hospital Palembang starting on January 1, 2005 through December 31, 2009. The number of maternal mortality (50 samples) was included in the case group. For the control group, we took physiological labor cases that occurred in the intervening days ± 60 days of the incident, which matched based on maternal age, a total of 150 cases (cases and controls ratio 1:3). Risk factors were grouped according to the framework made by McCarthy et al, which is distant factor (maternal education and husband's occupation), intermediate factors (subject age, parity, residence, referral status, number of ANC visits, birth spacing, first attendance, labor facility and prior medical history), and near/outcome factors (type of delivery, complications of pregnancy, childbirth and puerpureal). We performed bivariate analysis to see what factors are significant. Furthermore, we performed multivariate analysis of the significant factors to determine which factors were the most influential on the occurrence of maternal mortality.

The data was processed with SPSS 14 program, using Chi Square test and Fisher's exact test.

RESULTS

During the five years of 2005-2009, there were 109 maternal mortality and 11,453 live births. The number of maternal mortality in Dr. Mohammad Hoesin General Hospital, Palembang for five years (2005-2009) is shown in Table 1.

Table 1. The Number Of Maternal Mortality and Live Births in Dr. Mohammad Hoesin General Hospital, Palembang for Five Years (2005-2009)

Years	No. of Maternal Mortaliy	No. of Live Births
2005	13	1398
2006	18	2092
2007	25	2721
2008	25	2438
2009	28	2804
Total	109	11453

Risk factors were grouped into distant, intermediate, and outcome factors. Distant factors consist of maternal education and husband's occupation. We obtained 86% of the cases had education <9 years, while in the control group only 59.3% had ≥ 9 years of education. Based on Chi Square statistical test, there was a significant association between maternal education levels with the incidence of maternal mortality, OR 8.96 (p=0.001).

We found that in 58% of cases the husband are laborers, while in the control group 73.3% does not work as laborers. Based on Chi Square test there is a significant relationship between the husband's occupation with the incidence of maternal mortality, OR 3.79 (p=0.001).

Intermediate factors consist of age, parity, residence, referral status, number of ANC visits, birth spacing, first attendant, birth place and the prior medical history.

Age, parity and birth spacing factors didn't show any significant associations with the incidence of maternal mortality (p> 0.05). On the residence factors, we found a significant association with maternal mortality (OR 7.41, p=0.001), where 64% of the cases resided in rural area, while 80.7% of the control group residing in urban area.

Most of the research subjects were referred patients (84% in the case group and 54.7% in the

control group) and there is a significant association between the referral status and maternal mortality (OR 4.01, p=0.001).

In the case group, 64% had <4 times ANC visits while 62.7% of the control group had ≥ 4 times ANC visits, and there was a significant association between the number of ANC visits and the incidence of maternal mortality (OR 2.98, p = 0.001).

On prior medical history factors, the majority of cases had no history of previous illness (88%), while the control group was purposively selected with no history of previous illness. There is a significant association between prior medical history and maternal mortality (OR 4.40, p=0.001). Outcome factors consist of the type of delivery, complications of pregnancy, childbirth and puerpural.

Table 2. The Relationship between Distant, Intermediate, and Outcome Factors and Maternal Mortality

Risk Factors	Case		Control		OR	95% CI	p
	n	%	n	%			
Distant Factors							
Maternal education							
< 9 years	43	86	61	40.7	8.96	3.78 - 21.23	0.001*
≥ 9 years	7	14	89	59.3			
Husband's occupation							
Laborer	29	58	40	26.7	3.79	1.94 - 7.40	0001*
Non Laborer	21	42	110	73.3			
Intermediate Factors							
Age (year)							
< 20 and > 35	18	36	59	39.3	0.86	0.44 - 1.68	0.675*
20 - 35	32	64	91	60.7			
Parity							
0 and ≥ 4	37	74	126	84.0	0.54	0.25 - 1.16	0.115*
1 - 3	13	26	24	16.0			
Residence						3.66 - 15.01	
Rural	32	64	29	19.3	7.41		0.001*
Urban	18	36	121	80.7			
Referral status							
Non referral	8	16	65	43.3	4.01	1.76 - 9.13	0.001*
Referred	42	84	85	56.7			
No. of ANC visits							
< 4 times	32	64	56	37.3	2.98	1.53 - 5.80	0.001*
≥ 4 times	18	36	94	62.7			
Interpregnancy interval							
< 24 months	24	48	69	46.0	1.08	0.57 - 2.05	0.806*
≥ 24 months	26	52	81	54.0			
First attendant							
Non PHA	9	18	0	0.0	4.65	3.55 - 6.11	0.001*
PHA	41	82	150	100			
Delivery place							
Outside RSMH	13	26	0	0.0	5.05	3.78 - 6.74	0.001**
RSMH	37	74	150	100			
Prior medical history							
Yes	6	12	0	0.0	4.40	3.40 - 5.71	0.001**
No	44	88	150	100			
Outcome Factors							
Mode of delivery							
Assisted	17	48.6	0	0.0	9.33	6.03 - 14.44	0.001
Non Assisted	18	51.4	150	100			
Complications of pregnancy							
Yes	17	34.0	0	0.0	5.54	4.07 - 7.55	0.001
No	33	66.0	150	100			
Complications of delivery							
Yes	30	60.0	0	0.0	8.50	5.63 - 12.82	0.001
No	20	40.0	150	100			
Complications of puerpural							
Yes	3	6.0	0	0.0	4.19	3.26 - 5.37	0.001
No	47	94.0	150	100			

**Chi Square test; **Fishers test*

The control group did not have any complications, because intentionally to avoid the confounding factors. There were 34% cases of pregnancy complications, 60% complications of childbirth and 6% puerpural complications. Using Fisher's exact test, there was a significant association between complications of pregnancy, childbirth and puerpural with the incidence of maternal mortality ($p<0.05$). The relationship between distant, intermediate and outcome factors and maternal mortality is shown on Table 2.

To determine the most contributing risk factors to the occurrence of maternal mortality, we conducted logistic regression to variables that have a significance in the bivariate analysis, avoiding prior history and complications factors due to fact that the control group did not have it. Complete results of logistic regression shown on Table 3.

Table 3. Logistic Regression Results

Factors	Unadjusted			Adjusted		
	B	OR	p	B	OR	p
Education	1.891	8.96	0.001	1.749	5.74	0.001
Residence	1.848	7.41	0.001	1.537	4.65	0.001
Husband's occupation	0.069	3.79	0.001			
Referral status	–0.079	4.01	0.001			
No. of ANC	–0.074	2.98	0.001			
First attendant	20.230	4.65	0.001			
Mode of delivery	23.293	9.33	0.001			
Labor facility	21.841	5.05	0.001			
Constanta	–4.255					

Based on the adjusted logistic regression results, the most contributing factors to the occurrence of maternal mortality in Dr. Moh. Hoesin General Hospital Palembang during 2005-2009 sorted by the value of OR were maternal education and residence ($p <0.05$).

DISCUSSIONS

This is a case control study which examined 200 subjects, consisted of 50 case subjects (maternal mortality) and 150 control subjects.

The most common cause of maternal mortality are preeclampsia/eclampsia (50%), followed by hemorrhage (28%), but according to Bappenas, the most common cause of maternal mortality in Indonesia is caused by bleeding cases (30%).[3] Thanks to advances in anesthesia, surgical techniques, intravenous fluids and transfusions as well as the increasing role of antibiotics, maternal mortality due to bleeding and infection can be markedly reduced. Meanwhile, the patients with preeclampsia are mostly ignorant and it is often too late to seek help after the clinical symptoms progress to severe preeclampsia with all of its complications, thus maternal mortality can not be derived.[5]

Risk factors of maternal mortality were classified into 3 groups of distant, intermediate and outcome factors. Distant factor consists of maternal education and husband's occupation. Our result suggests that there is a significant association between maternal educational level and husband's occupation with the incidence of maternal mortality. Maternal education and husband's occupation will indirectly influence family socioeconomic status. These factors will limit women's access to education, good nutrition, and health services, which would make the threat of maternal mortality even higher.[6] Karlsen et al. research at 373 medical centers in 24 countries shows that women with the amount of education between 1 and 6 years had a 2-fold risk for mortality compared to those who are educated more than 12 years.[7] The study by Mochtar also found that women who died in the department of Dr. Mohammad Hoesin General Hospital, Palembang in 1986 to 1989 have spouses who worked as day laborers and do not work. This suggests that the husband's occupation, which is associated with socioeconomic status of a family, is also a risk factor for maternal mortality.[8]

Distant factors consisted of age, parity, residence, referral status, number of ANC visits, first attendant, labor facility, birth spacing and history of the disease. Our results indicate that age and parity did not have a meaningful relationship to the occurrence of maternal mortality. These results are contrary to research Midhet et al. in Pakistan, where they found the risk was significantly higher in pregnant women with less than 20 years of age and over 35 years compared with those between 20-34 years old.[9]

In this study, there is a significant relationship between residence with the incidence of maternal mortality, where those who live outside the city of Palembang has a risk for maternal mortality 7.41 times more compared to those living in the city. Research by Mohammed in Sudan showed much

differences between the MMR in urban and rural areas (369 vs. 872 per 100,000 live births).[10] Mochtar reported that the risk for the occurrence of maternal mortality in patients who resides outside of the city of Palembang was 12 times greater than those who resides in the city.[8]

In our study, most of the research subjects are referred patients (84% case group and 54.7% control group). This is reasonable considering that Dr. Mohammad Hoesin General Hospital, Palembang is a type A referral hospital, so that the cases were mostly referred cases. However, most mortality occurred within <48 hours after hospital admission. This indicates that most referral were delayed referral. Budagama reported that the risk of mortality was 11 times larger when the referral hospital could not be reached within 2 hours.[11]

In this study, we also found a significant association between the number of ANC visits of less than 4 times with the incidence of maternal mortality. Antenatal care policy states that the ANC should be given according to national standards, at least 4 times during the pregnancy.[2] Fibriana's research in Cilacap also found the same thing, in which the women without adequate ANC visits has a mortality risk of 22.7 times compared to those who had adequate visits.[12]

Distribution of birth spacing in the study in both groups the majority of pregnancies had intervals ≥24 months. Shorter birth spacing can cause morbidity and mortality in both mother and child. The research in various countries shows significant relationship between birth spacing with the risks to both mother and child's health. In the study by Rahman et al. in Bangladesh, maternal mortality risk is found to be higher in the women with pregnancy interval <24 months compared with women with pregnancy intervals of 24-59 months, but found no statistically significant difference.[13] The same result was found in this study, in which there is no significant relationship between pregnancy interval with maternal mortality.

Only a small group of case subjects with a history of prior disease which is 12%. However, there was a significant association with maternal mortality. Fibriana reported that in women who have a history of disesase before pregnancy or during the pregnancy period, are at risk for maternal mortality 29.4 times more likely than mothers with no history of previous illness.[12]

Outcome factors consist of the type of delivery, complications of pregnancy, childbirth and complications of childbirth complications. All the factors have significant associations with the incidence of maternal mortality.

Of all the factors, the most dominant factor affecting maternal mortality were maternal education and residence. Several previous studies showed similar results with this study. Högberg reported that mothers with no education are more likely to die than those who are better educated, thus emphasizing the need for expansion of educational opportunities for women, and the importance of reducing poverty.[14] Midhet in Pakistan stated that women living in remote rural areas without access to transportation and telecommunications will likely die from complications of pregnancy and childbirth.[10] This is related to the "Three Delays", defined as the delay to seek help if a complication arises because of the ignorance to recognize danger signs, and delays in reaching referral places because of the distance from residential area and difficulty in transportation from the point of referral, which will cause a delay for a woman to get help, and resulting in mortality.[4]

CONCLUSIONS

Risk factors that contribute to occurrence of maternal mortality in Dr. Moh. Hoesin General Hospital Palembang during the period of 2005-2009 were categorized as distant factors (maternal education and husband's occupation), intermediate factors (residence, referral status, numbers of ANC visits, first attendant, labor facility and history of prior medical history) and outcome factors (type of delivery, complications of pregnancy, childbirth and puerpural), while the most contributing factor is maternal education and residence.

SUGGESTIONS

Prospective studies are needed to get a more complete and informative data, in order to address whether the effect of risk factors in this study is still a problem in the incidence of maternal mortality.

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